NEURAL NETWORK MODELING FOR PREDICTING RAINFALL PRECIPITATION

A project submitted to the Graduate School in partial fulfilment of the requirements for the degree Master of Science (Information Technology), Universiti Utara Malaysia

by
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ABSTRACT (BAHASA MALAYSIA)

Projek ini bertujuan untuk membangunkan suatu model rangkaian neural perambatan balik untuk meramal jumlah hujan yang turun di negeri Kedah. Ramalan hujan adalah penting untuk Skim Pengurusan dan Pengawalan Air di Kedah memandangkan air hujan menyumbang lebih daripada 50% daripada jumlah air di negeri berkenaan. Model rangkaian neural perambatan balik untuk projek ini telah dibangunkan dengan menggunakan bahasa pengaturcaraan C dan Visual Basics. Data yang digunakan untuk melatih dan menguji model rangkaian neural tersebut telah diperolehi daripada 'Muda Agricultural Development Authority' (MADA). Data merangkumi jumlah hujan untuk 31 pusat pengumpulan air hujan dengan jangkamasa maksima selama 29 tahun. Selepas rangkaian neural ini dilatih, didapati rangkaian neural berupaya membuat jangkaan dengan ketepatan sebanyak 72.44%, berbanding dengan 69% jika jangkaan dibuat dengan pendekatan regresi. Sebagai usaha pertama di Kedah, projek ini telah menunjukkan kebolehan rangkaian neural untuk menjangka air hujan di Kedah. Ketepatan jangkaan air hujan dapat ditingkatkan di masa hadapan dengan memperbaiki struktur rangkaian dan data.

ABSTRACT (ENGLISH)

This project aimed at developing a back propagation neural network model to predict rainfall precipitation for Kedah. Rainfall prediction was essential in the Water Management and Control Scheme (WMCS) of Kedah as rainfall precipitation constituted more than 50% of the total water sources to the state. The back propagation neural network model had been developed using C and Microsoft's Visual Basics. The data used to train and test the network built was provided by Muda Agricultural Development Authority (MADA). Data obtained consisted of rainfall levels for a maximum of 29 years (1970-l 998) for 3 1 rainfall stations in Kedah. Upon completion of the training, the best network model produced prediction accuracy of 72.44% for the rainfall levels and this indicated an improvement over the regression approach of 69%. Being the first attempt at predicting the rainfall precipitation in Kedah, the project had succeeded in initiating an application in this area. Further works such as modifying the inputs and the network model could be performed to improve the prediction accuracy of the network.

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I would also like to thank the Muda Agricultural Development Authority (MADA) for supplying the data of rainfall precipitation of past years. The data has been tremendously useful in the development of neural network model.

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Chapter 1 Introduction

The project is initiated upon the requests of course TZ 6996 as one of the graduation requirements of MSc (IT). The aim of the project is to develop a rainfall level forecasting model as part of the irrigation management system for the northern regions of Malaysia. The irrigation management system of Kedah / Perlis, which is maintained by Muda Agricultural Development Authority (MADA) is the biggest irrigation management system in the country. There are 73 rainfall collection centres monitored by MADA throughout Kedah / Perlis through the Water Management & Control Scheme (WMCS). Each station collects and represents the water level of the rainfall for an area of 16-km-sq. The system monitors the water level of 4 sources, which include the rain, the dams, the river and 12 recycle stations scattered around the region. There are 3 dams available in Kedah / Perlis, namely Muda, Ahning and Pedu. Of the 4 sources, rainfall precipitation constitutes more than 50% of the total water sources to the states (Teoh & Chua, 1989). Rainfall precipitation in simple term means the total amount of rain that falls on ground. Since the rainfall precipitation plays a vital role in the irrigation management system, this project attempts to forecast the rainfall level of Kedah / Perlis using back propagation neural network modeling.

Neural network, as an evolving technology, is an information system modeled after the human brain's network of electronically interconnected basic

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